Iowa Science Teachers Journal

Volume 27 | Number 2 Article 3

1990

Women and Minorities in Technical Courses in Iowa

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WOMEN AND MINORITIES IN TECHNICAL COURSES IN IOWA

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Recent national reports indicate that math and science education is in a crisis in the United States (*Changing America,* 1988 and *Women and Minorities in Science and Engineering,* 1988). Concern has been expressed by many national groups that we must attract and keep more young people in the pipeline to meet future needs for scientists and engineers. Because the need for scientists is projected to increase by 45 percent, for engineers 32 percent and for technicians 36 percent, but the population of 18-24 year olds entering the labor force is expected to decline, the U.S. must attract more women and minorities to these fields (U.S. Department of Labor, 1987). Currently, only four percent of the nation's engineers and 25 percent of the nation's scientists are women (*Women and Minorities in Science and Engineering*, 1988). This leaves a large pool of women for future scientists, engineers and technicians. Complete education and utilization of under-represented groups is the only way the nation can fulfill its projected need for technical workers.

Table 1

Minority Enrollment in Higher Level Courses—1987-88

Iowa Public High Schools

	Bur-lington	Cedar Rapids	Coucil Bluffs	Daven-port	Des Moines	Iowa City	Mus-catine	Sioux City	South Tama	Water-loo
Total Minority	8.4	8.0	3.7	18.9	18.0	9.5	12.1	10.4	13	21.9
Algebra	3.0	3.0	3.4	12.7	22.1	10.0	6.0	6.0	6.0	18.0
Trigo-nometry		0*	4.0	9.8*	7.9*	7.0		6.7	5.0	
Calculus and/or Senior Math	0*	2.0*	4.0	8.8	7.2	7.2	16	5 10	10	10* 8*
Chemistry	7.0	1.0*	4.0	14.3	16.2	12 7 7	6	5.6	2*	10*
Adv. Chemistry	6.0	8.0	7.0	14.5	3.4*		6	8.3	0	
Physics	5.0	5.0	1.5	11.1	11.2	19	3	4.7	0	16
Adv. Physics	3.0	2.0*	11.0		15.7		2.7*			

*Indicates significant disproportion of students as defined by state guidelines. Data from: State of Iowa Public Schools Race Equity Reports—1987-88

Iowa is frequently recognized for its educational excellence. Iowa students' scores on national achievement tests usually lead the nation. But does this excellence extend to all young people regardless of race or gender? What is the status of math, science and technical education relative to gender and ethnic concerns in the state of Iowa?

Few minority students in Iowa schools are preparing for careers in science (Table 1). In 1987-88, the percentage of minority students enrolled in higher level math and science courses exceeded the percentage of minority students in only one Iowa school district. Data for 1988-89 revealed the same pattern (Table 2).

Table 2

Minority Enrollment in Higher Level Courses—1988-89

Iowa Public High Schools

	Davenport	Des Moines	Mason City	Sioux City	Waterloo
Total Minority	19.8	18.0	5.2	11.1	21.7
Geometry	15.0	17.4	2.0	6.0	22
Int. Algebra	12.7	16.3	2.3	5.0	14
Trigonometry	9.8*	14.0	6.7	8.7	14
Senior Level Math and/or Calculus	8.8*	12.0		13.7	4*
Adv. Biology	11.6		1.4	3.7	15
Chemistry	14.3	15.4	2.2	5.7	14
Adv. Chemistry	14.5		5.7	13.9	0*
Physics	11.1	11.7	4.8	8.6	14

*Indicates significant disproportion of students as defined by state guidelines.

Source: State of Iowa Public Schools Race Equity Reports—1988-89

More males than females are enrolled in Iowa's high school math courses (Table 3). The disparity is greater for higher level courses. Many young people are dropping out of higher level math courses, but the problem is more acute with females. Some students lack the ability to succeed in the higher level courses, but many of those who have the ability do not sign up.

More than 36,000 students are enrolled in biology classes in the state of Iowa (Table 4). In many schools, this course is required. Although many of these students have the academic ability to successfully complete a chemistry course, more than half drop out at this point. Only about 18,000 go on to take chemistry, usually a non-required course. Approximately 9,000 students advance to take physics. It is

here that the gender gap becomes most evident. Although dropping out of the sciences is a problem for all students, it is more pronounced among female students. In physics, the disparity is 5,592 males to 3,823 females.

Table 3

Math Courses

Iowa Public High Schools

	81-82		85-86		88-89	
	Male	Female	Male	Female	Male	Female
Algebra	16,129	17,140	17,609	17,752	16,441	16,352
Algebra Adv.	8,497	8,490	9,631	9,986	9,483	10,002
Geometry	11,187	10,951	13,119	12,908	11,697	12,178
Trigonometry	2,140	1,629	2,781	2,326	2,690	2,403
Senior-Topical	2,923	2,570	3,449	2,791	3,822	3,186
Calculus	888	612	1,124	880	1,421	1,167
Math, Computer	3,587	2,352	9,258	7,146	6,658	5,344
Totals All Math	64,245	58,921	73,427	67,504	66,357	62,273

Source: Iowa Department of Education

Table 4

Science Courses

Iowa Public High Schools

	81-82		85-86		88-89	
	Male	Female	Male	Female	Male	Female
Biol./Bot./Zool.	18,068	18,388	20,327	20,553	18,292	18,378
Chemistry	7,395	7,298	9,066	8,879	9,152	9,181
Physics	4,467	2,339	5,511	3,540	5,592	3,823
Sci.-Computer	—	—	652	480	592	537
Totals All Sciences	57,502	53,446	62,062	58,032	55,790	52,676

Source: Iowa Department of Education

The gender disparity is even more pronounced in selected trade and industry courses (Table 5). The perception often exists that these courses prepare students for immediate employment; however, these courses are also important for the college bound. As an example, activities and information learned in an electronics program would certainly benefit the student entering an electrical engineering program. Not taking part in these programs seriously handicaps young women, not only those planning to seek work immediately after high school but those going to 2-year and 4-year institutions as well.

Table 5

Selected Trade and Industry Courses*

Iowa Public High Schools

	81-82		85-86		88-89	
	Male	Female	Male	Female	Male	Female
Automotive	382	7	4,130	290	933	26
Cabinetry/Carpentry	1,732	60	--	--	647	15
Construct. Prod.	--	--	1,558	83	--	--
Drafting & Drawing	3,765	397	6,104	554	1,145	183
Energy & Power	--	--	1,496	50	--	--
Elec./Electronics	1,823	42	4,116	348	572	27
General Shop	--	--	4,948	505	--	--
Mechanics	1,896	104	4,352	260	384	39
Metals	3,977	118	5,432	174	922	10
Shop Machine	1,186	115	--	--	274	4
Trade/Ind-Other	761	381	--	--	--	--
Trade/Ind Coop	842	314	--	--	668	363
Welding	1,992	11	1,548	30	300	4
Woodworking	6,413	421	9,833	595	1,493	104
Total All Courses	26,208	2,550	46,254	3,702	8,460	1,193

*Selected on the basis of total enrollment over 1000 for any year.

Source: Iowa Department of Education

The gender disparity in technical programs at Iowa community colleges is similarly pronounced. Of the programs reviewed, all showed less than nine percent female enrollment (Table 6). Information from Iowa private colleges and universities also reveals a gender imbalance (Table 7). All programs but one enrolled fewer women than men in chemistry, physics, computer science and math courses.

The University of Iowa and Iowa State University also show gender disparities in technical curricula (Figure 1). Comparisons with a group of peer institutions (Arizona, California-Davis, Illinois, Michigan State, Minnesota, North Carolina State, Ohio State, Purdue, Texas A&M and Wisconsin) show that the problem appears to be more pronounced in Iowa than in other states (Figure 2).

Several conclusions can be reached by reviewing these data.

1. The percentage of minority students in higher level math and science classes is less than their representation in the public schools.

2. The percentage of female students in higher level math and science classes and in vocational technical classes is less than their representation in the public schools.

3. Many young people are being lost from possible science, engineering and technical careers by precollege course choices, but the loss is most pronounced as they proceed from high school to post-secondary education programs.

Table 6

Iowa Public Community Colleges and Vocational-Technical Schools Fall 1988

Program	Number of Schools	Females/ Total Students	Female Percentage
Agricultural Production Agricultural Services	7 8	31/432	7.2%
Electronics	15	55/639	8.6%
Automotive Mechanics	15	14/501	2.8%

Source: Iowa Department of Public Instruction
Area School Division
Term Enrollment Report

Table 7

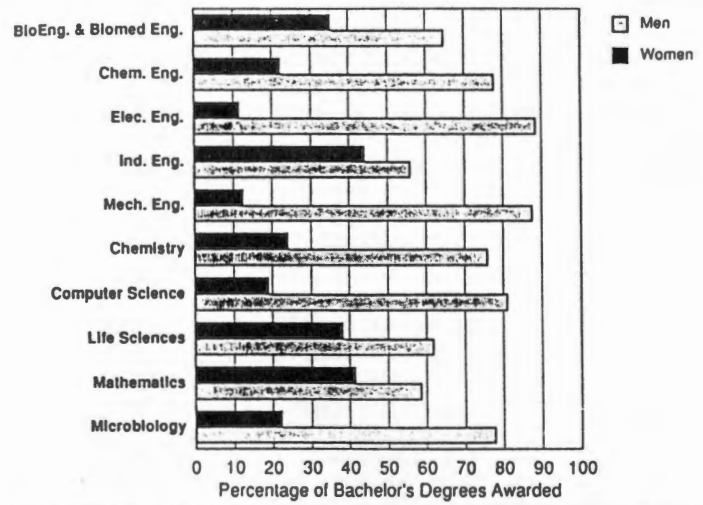
Female Enrollment in Iowa Private Colleges/Universities Fall 1988

Institution	Declared Major			
	Chemistry	Physics	Com. Sci.	Math
A	25%	25%	16.6	57.1
B	33.3	50.0	9.1	41.1
C	34.4	0	3.1	44.5
D	5.9	37.5	—	26.9
E	36.9	19.2	40	57

Source: Registrar's Office of Coe, Dordt, Drake, Grinnell, Wartburg

Selected Science and Engineering Disciplines

University of Iowa — 1987-88

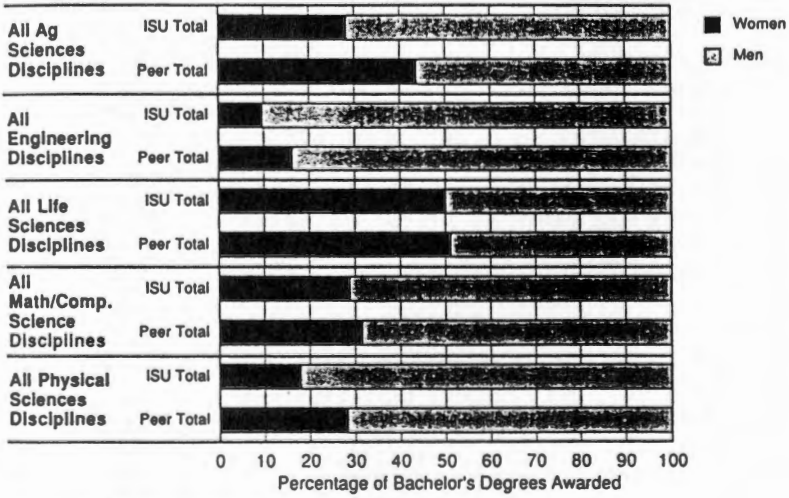


Source: Iowa State University, Office of Institutional Research, Based on Reports Prepared for the Integrated Post-Secondary Education System (IPEDS), United States Department of Education.

Figure 1

Degrees Awarded in Science and Engineering Disciplines

Iowa State University vs. Peer Institutions



Source: Integrated Postsecondary Education Data System (IPEDS)
United States Department of Education

Figure 2

4. The under-representation of women in technical curricula at the post-secondary level is more pronounced in Iowa than in institutions in other states.

5. While disproportionate enrollment of females and minorities occurs at the high school level, much greater disparities are evident at the college level.

6. The most disproportionate course enrollment at the high school level is in vocational technical courses.

7. Complete data are not available to assess achievement levels by gender and ethnicity in math and science.

From an analysis of the data, several recommendations were made.

1. Public schools should collect achievement data in math and science classes by gender and ethnicity.

2. Public schools should collect enrollment data in higher level math and science courses by gender and ethnicity.

3. Course dropping patterns should be monitored.

4. Career education programs should be reviewed, and the methods of delivering these programs may need to be changed to seek more involvement from parents and teachers. (According to Swenson and Whigham, 1987, parents, then teachers and then counselors, are the most important influence on career choices.)

5. Faculty development programs are needed in the area of gender and ethnic awareness, learning styles and effective teaching methods for women and minorities. (Programs such as GESA [Gender/Ethnic Expectations and Student Achievement] train teachers to use effective methods for all students and to have similar expectations regardless of gender or ethnicity.)

6. This type of faculty developed program is needed at all academic levels (K-12 and post-secondary).

7. Programs should be developed in public schools, community colleges and universities to assist women and minorities in meeting their academic potential. (The Women in Science and Engineering Program at Iowa State University is an example of this type of program.)

Improving this aspect of education in the state of Iowa will be a big job, but the challenge can by met. Working together, public and private school teachers, school administrators, policymakers, post-secondary educators, business and industry leaders and science and engineering professionals can solve the problem of the under-representation of women and minorities in science, engineering and technical curricula and careers.

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